

**AMENDMENTS TO THE CLAIMS**

1. (currently amended) A process for purifying hydrogen ~~from a stream of reformat gases~~ comprising:
  - a. preparing a flow cell in which 2 gas flows are separated by an oxygen-ion conducting two-phase solid state membrane, wherein the first phase is ionically conducting and the second phase is electronically conducting,
  - b. heating said cell to greater than 500 °C,
  - c. passing said a stream of reformat gases on one side of said membrane and steam on the second side of said membrane, wherein at least a portion of the steam on the second side of said membrane is reduced to produce purified hydrogen,
  - d. separating said purified hydrogen from said second side of said membrane.
2. (original) The process of claim 1 wherein said reformat gases are selected from the group consisting of:
  - a) mixtures of carbon monoxide and hydrogen;
  - b) mixtures of carbon monoxide and hydrogen containing small quantities of other hydrocarbons or hydrocarbon reformat or inert gases such as Ar, He or nitrogen;
  - c) by-products from the partial oxidation or steam reformation of methane;
  - d) partial oxidation or steam methane reformation products of other hydrocarbons;
  - e) products of carbon dioxide reformation of hydrocarbons;
  - f) products of autothermal reformation of methane and other hydrocarbons; and mixtures thereof.
3. (canceled)
4. (currently amended) The process of claim 1 wherein the first phase of said membrane is selected from the group consisting of:  
~~strontium doped lanthanum iron cobalt oxide of the composition  $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$ , where~~  
 $0 < x < 1$  and  $0 < y < 1$ ;

$\text{La}_{(1-x)}\text{Ca}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$ , where  $0 < x < 1$  and  $0 < y < 1$ ;

$\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{y1}\text{Fe}_{y2}\text{Ni}_{y3}\text{Cr}_{y4}\text{O}_3$ , where  $x < 1$  and  $y1 + y2 + y3 + y4 = 1$ ;

yttria stabilized zirconia doped with an oxide selected from the group consisting of  $\text{MnO}_2$ ,  $\text{TiO}_2$ ,  $\text{FeO}$ ,  $\text{Cr}_2\text{O}_3$  and other transition metal oxides;

undoped  $\text{CeO}_2$ ;

$\text{CeO}_2$  doped with an oxide selected from the group consisting of  $\text{MnO}_2$ ,  $\text{TiO}_2$ ,  $\text{FeO}$ ,  $\text{Cr}_2\text{O}_3$  and other transition metal oxides;

$\text{RE}_2\text{O}_3$  doped  $\text{CeO}_2$ , where RE is Y, Yb, Sc, or Gd; and

$\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$ , where  $x < 1$ ,  $y < 1$ , and mixtures thereof.

5. (canceled)

6. (previously presented) The process of claim 1, wherein the first phase of said membrane is  $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$ , where  $0 < x < 0.4$  and  $0 < y < 1$ .

7. (previously presented) The process of claim 1, wherein said membrane is  $\text{La}_{0.9}\text{Sr}_{0.1}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_3 + \text{Pd}$ .

8. (previously presented) The process of claim 1, wherein the second phase of said membrane is a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au.

9. (previously presented) The process of claim 4, wherein the second phase of said membrane is a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au.

10. (previously presented) The process of claim 1, wherein the said membrane comprises:  
a first phase comprising one or more of yttria stabilized zirconia doped with an oxide selected from the group consisting of  $\text{MnO}_2$ ,  $\text{TiO}_2$ ,  $\text{FeO}$ ,  $\text{Cr}_2\text{O}_3$  and other transition metal oxides,  $\text{RE}_2\text{O}_3$  doped  $\text{CeO}_2$ , where RE is Y, Yb, Sc, or Gd, and  $\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$ , where  $x < 1$ ,  $y < 1$ ; and  
a second phase comprising one or more of a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au.

11. (previously presented) The process of claim 1, further comprising including a small amount of hydrogen with the heated steam.

12. (previously presented) The process of claim 11, wherein steam is present in the heated steam in an amount less than or equal to about 3wt%.
13. (currently amended) A system for purifying hydrogen gas, comprising:
- a source of reforming gas,
  - a source of steam,
  - a flow cell comprising a first oxidizing compartment and a second reducing compartment separated by a two-phase solid state membrane, wherein the first phase is oxygen-ionically conducting and the second phase is electronically conducting,
  - means for directing the reforming gas across the membrane in the first compartment,
  - means for directing the steam across the membrane in the second compartment, wherein at least a portion of the steam directed across the membrane in the second compartment is reduced to produce purified hydrogen, and,
  - a condenser downstream from the second compartment for separating steam from hydrogen.
14. (currently amended) A process for purifying hydrogen ~~from a stream of reformat gases~~ comprising:
- a. preparing a flow cell in which 2 gas flows are separated by an oxygen-ion conducting solid state membrane selected from the group consisting of:
    - ~~strontium doped lanthanum iron cobalt oxide of the composition  $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$ , where  $0 < x < 1$  and  $0 < y < 1$ ;~~
    - $\text{La}_{(1-x)}\text{Ca}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$ , where  $0 < x < 1$  and  $0 < y < 1$ ;
    - $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{y1}\text{Fe}_{y2}\text{Ni}_{y3}\text{Cr}_{y4}\text{O}_3$ , where  $x < 1$  and  $y1 + y2 + y3 + y4 = 1$ ;
    - yttria stabilized zirconia doped with an oxide selected from the group consisting of  $\text{MnO}_2$ ,  $\text{TiO}_2$ ,  $\text{FeO}$ ,  $\text{Cr}_2\text{O}_3$  and other transition metal oxides;
    - undoped  $\text{CeO}_2$ ;
    - $\text{CeO}_2$  doped with an oxide selected from the group consisting of  $\text{MnO}_2$ ,  $\text{TiO}_2$ ,  $\text{FeO}$ ,  $\text{Cr}_2\text{O}_3$  and other transition metal oxides;

$\text{RE}_2\text{O}_3$  doped  $\text{CeO}_2$ , where RE is Y, Yb, Sc, or Gd; and

$\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$ , where  $x < 1$ ,  $y < 1$ , and mixtures thereof,

- b. heating said cell to greater than 500 °C,
- c. passing ~~said~~ a stream of reformat gases on one side of said membrane and steam on the second side of said membrane, wherein at least a portion of the steam on the second side of said membrane is reduced to produce purified hydrogen,
- d. separating said purified hydrogen from said second side of said membrane.